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USAEPG - SIG 920-135

TEST PLAN  
EVALUATION OF  
QRC-23 B(T) DUAL-BAND  
CARCINOTRON JAMMER (U)

(PROJECT 33-00-0000)



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USAEFG-SIG 920-135, Test Plan Project 33-00-0000, "Evaluation of the QRC-23B(T) Dual-Band Carcinotron Jammer" (U), has been prepared by the Electronic Warfare Department and is published for the information of all concerned. Suggestions or comments relative to this report are invited and should be addressed to the Commanding General, U. S. Army Electronic Proving Ground, Fort Huachuca, Arizona, ATTN: SIGR 0000.

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TEST PLAN

EVALUATION OF QRC-23B(T) DUAL-BAND CARCINOTRON JAMMER (U)

Project Nr 33-00-0000

AUTHORITY

(U) These tests will be performed as a part of Project Nr 33-00-0000 of the USAEPG Technical Program. Authorization is contained in CSigO COP FY 59 paragraph 2a(6)(a)3 and CDOG paragraph 842f, SIGCCD 56T4.

OBJECTIVE

*plans are presented*  
(U) ~~The objective of the tests is~~ to obtain the data necessary to evaluate the application of multi-band carcinotron jammers of the QRC-23B(T) type when employed in active ground-to-ground and air-to-ground countermeasures against various types of radar equipment. *↑*

October 1958

Electronic Warfare Department  
U. S. Army Electronic Proving Ground  
Fort Huachuca, Arizona

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## FOREWORD (U)

This test plan for the evaluation of the 3/4-ton truck and U1-A aircraft installations of the QRC-23B(T) Dual-Band Carcinotron Jammer employed against ground-based radar has been prepared by the Electronic Warfare Department as a part of Project 33-00-0000 of the U. S. Army Electronic Proving Ground (USAEPG) Technical Program. The plan prescribes the types of tests to be conducted and the methods of execution, and will serve as a guide for test personnel in preparing for and conducting the operational field tests.

These installations fabricated at USAEPC are only instrumented for the collection of data which may lead to possible application of this equipment in tactical vehicles. The effectiveness of the various jamming signals of the QRC-23B(T) against ground-based radars of the mortar-locating, combat surveillance, air surveillance, and tracking types will be ascertained.

WILLIAM G. SKINNER, JR.  
Lt Col SigC  
Chief, Electronic Warfare Department

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ABSTRACT

(U) The various tests included in this plan are intended to evaluate the effectiveness of the QRC-23B(T) Dual-Band Carcinotron Jammer.

(S) The bench tests include the performance and operating test of the QRC-23B(T) transmitter and heat exchanger. ~~Also~~ <sup>an</sup> evaluation of an appropriate transmission line and antenna system will be performed. The ground-to-ground field tests will be conducted against a mortar-locating radar (AN/MPQ-10A) and a combat surveillance radar (AN/TPS-21). ~~These tests will determine the best type of modulation and the effective jamming area and range against these radars.~~ The U1-A aircraft-mounted QRC-23B(T) will be used against AA Fire Control System M-33 surveillance and tracking radars, an AN/GPG-1 tracking radar, and an AN/MPQ-10A mortar-locating radar.

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## I. GENERAL

### 1. (U) TEST PLAN OUTLINE

The tests to be conducted are grouped under the following major headings:

#### a. (U) Bench Tests

Performance and operating characteristics will be determined.

#### b. (U) Field Tests

The effect of various jamming modulations, and the limits of effective jamming area of ground-based radars will be determined.

#### c. (U) Air Tests

The airborne QRC-23B(T) will be tested against surveillance, mortar-locating, and tracking radars.

### 2. (S) DESCRIPTION OF THE EQUIPMENT

The QRC-23B(T) consists of a dual-band jamming transmitter and a heat exchanger. ~~This equipment was designed and fabricated by the Halli Crafters Company on U. S. Air Force Call Nr 23S. This fabrication incorporated certain modifications stipulated by the Electronic Warfare Department, USAEPG.~~

The transmitter is designed to provide jamming capabilities against both search and tracking radar systems operating in the 2.5 to 3.3 ~~kmcs~~ and 8.2 to 11.0 ~~kmcs~~ frequency ranges. The minimum ~~cy~~ power output of either band is approximately 150 ~~watts~~. The dual-band transmitter has provision for: ~~amplitude modulation (am)~~ both noise and audio rate, narrow-band noise ~~frequency modulation (fm)~~, and wide-band audio rate ~~fm~~ of the ~~two~~ <sup>two</sup> carcinotron tubes.

For the purpose of these tests, the QRC-23B(T) has been installed in two vehicles, a 3/4-ton truck and a U1-A aircraft. In the U1-A installation, the QRC-23B(T) is substituted for the AN/ALT-6B equipment, which is part of the airborne multipurpose jammer. The 3/4-ton truck installation includes an AN/APR-9 receiver and an AN/ALA-6 direction finder for instrumentation purposes, the USAEPG fabricated rf transmission system, and a PU-346 prime power source.

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## 3. (S) TECHNICAL CHARACTERISTICS

The major technical characteristics of the QRC-23B(T) are shown in table I; the modulation characteristics of this equipment are shown in table II.

Table I. (S) Technical Characteristics of the QRC-23B(T)

Description	Characteristic
Frequency ranges	S-band - 2,500 to 3,300 mcs X-band - 8,200 to 11,000 mcs
Power output	150 watts minimum throughout both bands
Residual fm	5 to 8 mcs, both bands
AC power input	7 kva
Voltage	115 v $\pm$ 10 percent, 400 cps, 3 phase
Current	Phase A - 115 v, 21.9 amps Phase B - 114 v, 20.0 amps Phase C - 112 v, 17.5 amps
DC power input	
Voltage	28 v
Current	2 amps
Maximum duty cycle	Continuous
Efficiency of carcinotron tubes	20 to 30 percent
Cooling method	DC 200 silicon oil for high-voltage components at a flow rate of 10 gpm, with a system pressure of 35 psi - air cooling for low-voltage components by 50 cfm exhaust fan
Heat dissipation capability	5,000 watts at maximum temperature of $\pm$ 55 degrees C
Temperature requirements	
Operating	-55 degrees C to +55 degrees C
Nonoperating	-55 degrees C to +85 degrees C

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Table I. (S) Technical Characteristics of the QRC-23B(T). (Cont)

Description	Characteristic
Barometric pressures	
Operating	20,000 feet
Nonoperating	50,000 feet
Total approximate weight	300 lbs

Table II. (S) Modulation Characteristics of the QRC-23B(T)

Type of modulation	S-band	X-band
Frequency sweep	0 to 800 mcs (0 to $\pm 400$ mcs about center freq). Variable in 3 steps: 10 to 100 cps, 100 to 1,000 cps, 1,000 to 10,000 cps	0 to 2,400 mcs (0 to $\pm 1,200$ mcs about center freq). Variable in 3 steps: 10 to 100 cps, 100 to 1,000 cps, 1,000 to 10,000 cps
External fm (60 to 5,000 cps, 0.1 v maximum input)	0 to 800 mcs (0 to $\pm 400$ mcs about center freq)	0 to 2,400 mcs (0 to $\pm 1,200$ mcs about center freq)
FM noise	0 to 100 mcs (0 to $\pm 50$ mcs about center freq)	0 to 100 mcs (0 to $\pm 50$ mcs about center freq)
AM noise	0 to 30 percent minimum	0 to 30 percent minimum
External am (60 to 5,000 cps, 0.1 v maximum input)	0 to 30 percent minimum	0 to 30 percent minimum



## II. TEST REQUIREMENTS

### 4. (U) RESPONSIBILITY

a. (U) The project officer will insure that all arrangements for conducting the tests have been made. Requests for support will be submitted in accordance with paragraph 4, section 2, of the "Reference Handbook for Project Engineers."

b. (U) Any major deviations from the test procedures outlined in this plan will be coordinated and approved by the project engineer and Chief, Systems Division. The project officer or the project engineer may, if necessary, change test procedures on the spot and perform the required coordination at a later time. Details of all such changes will be recorded.

c. (U) The same operator should operate the equipment for the duration of any given set of tests. In this way, the operator's comments and evaluation of effectiveness will be consistent. The operator's background, experience, knowledge of equipment, and physical condition should be included with the data.

d. (U) Atmospheric conditions, including visibility, temperature, humidity, clouds, wind, precipitation, and barometric pressure will be stated for each day's test.

### 5. (U) TABLES OF REQUIREMENTS

Requirements for the tests stated in terms of time, personnel, and equipments are shown in tables III through VII.

Table III. (U) Tentative Time Schedule

Test	Estimated working days
Bench tests	5
Field tests (ground)	13
Field tests (air)	10
Total	28

Table IV. (U) Personnel Requirements

Type of personnel	Number	Source
Project officer	1	EWD
Project engineer	1	EWD
Field engineer	1	EWD
Jammer operating team	2	EWD
AN/MPQ-10A team	2	72d Sig Bn
M-33 operating team	3	72d Sig Bn
AN/TPS-21 team	2	CSD
AN/GPG-1 team	2	CSD
Security guards	As required	Post
Drivers	As required	EWD
Electronic technician	2	EWD
Communications team	3	EWD
Mortar crew	1	Post
Human factors personnel	1	EWD
Photographer	1	Post

Table V. (U) Major Items of Equipment

Description	Nomenclature	Quantity
Dual-band carcinotron jammer mounted in 3/4-ton vehicle, with trailer-mounted power unit	QRC-23B(T)	1
Mortar-locator radar	AN/MPQ-10A	1
Combat surveillance radar	AN/TPS-21	1
Combat surveillance radar	AN/GPG-1	1
AA Fire Control radar	AA FCS M-33	2
Mortar	- -	1

Table V. (U) Major Items of Equipment (Cont)

Description	Nomenclature	Quantity
U1-A aircraft	- -	1
L-19 aircraft	- -	1

Table VI. (U) Auxiliary Equipment

Description	Quantity	Purpose
Radio Set AN/VRC-17	3	Communications between teams
Radar scope camera	2	Spare photos
Spectrum analyzer	1	Bench tests and field tests
Signal Generator TS-155/UP	1	Target simulator
HP Signal Generator 616A	1	Bench tests
HP Signal Generator 620A	1	Bench tests
Multimeter (Simpson)	1	Bench tests
Transit, surveying	1	Range setup
Oscillator, Tektronix 535	1	Bench tests
Miscellaneous waveguide accessories	1	Bench tests
Balloon, target	1	Target
Rotating corner reflector	1	Target

Table VII. (U) Vehicles and Power Units

Type	Quantity	Purpose
3/4-ton truck	1	Equipment
1/4-ton truck	1	Liaison
2-1/2-ton truck	5	Communication teams
Power Unit PU-26/U	1	AN/MPQ-10A
L-19 aircraft	1	Target

b. (U) CHECKLIST FOR PROJECT OFFICER

The following is a checklist of necessary requirements and arrangements for the use of the project officer. The project officer will:

- a. Select and request the use of sites for each test (locations of all sites will be recorded as map coordinates).
- b. Provide for personnel and equipment.
- c. Arrange for frequencies and types of radio transmission.
- d. Obtain vehicles and drivers.
- e. Obtain POL requirements.
- f. Furnish water and lunches for personnel at test sites.
- g. Provide data sheets.
- h. Obtain topographical maps for recording site locations.
- i. Provide for individual safety precautions (steel helmets, first aid kits, etc.).
- j. When necessary, arrange for flight course and airborne requirements with Libby Airfield Operations.
- k. Arrange for briefing of pilots for coordination of tests, when applicable.
- l. Record equipment operating time, maintenance required, and other modifications.
- m. Provide for proper recording of data to include the following information:
  - (1) Time and duration of tests
  - (2) All pertinent electrical parameters
  - (3) All pertinent meteorological data
  - (4) All pertinent physical data (terrain, etc.)
- n. Arrange for briefing all personnel on daily (or weekly) scheduled testing.
- o. Contact the EWD Security Officer in regard to security of test sites.
- p. Provide for fire protection.

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## III. PRELIMINARY TESTS

### 7. (U) TEST 1. PERFORMANCE TEST

#### a. (U) Purpose

The purpose of test 1 is to insure that all components of the equipment are operating as required, before the QRC-23B(T) is installed in the vehicle.

#### b. (U) Time Required

The time required for this test will be four days.

#### c. (U) Procedure

The procedure is outlined in the Hallicrafters Handbook of Instructions, QRC-23B(T), paragraphs 5-10 through 5-21.

#### d. (U) Data Required

All data required by the handbook will be recorded.

### 8. (S) TEST 2. TRANSMISSION LINE EVALUATION

#### a. (U) Purpose

The purpose of test 2 is to determine the effect of antenna system VSWR on the rf power output of the QRC-23B(T).

#### b. (U) Time Required

The test will be performed concurrently with test 1.

#### c. (S) Procedure

(1) The equipment will be set up as shown in fig. 1.

(2) The S-band transmitter will be amplitude modulated by a 1,000 cps square wave.

(3) The transmitter frequency will be set to 8.5 kmcs and the transmission system tuned for minimum VSWR by tuning the adjustable short. Measure the rf power.

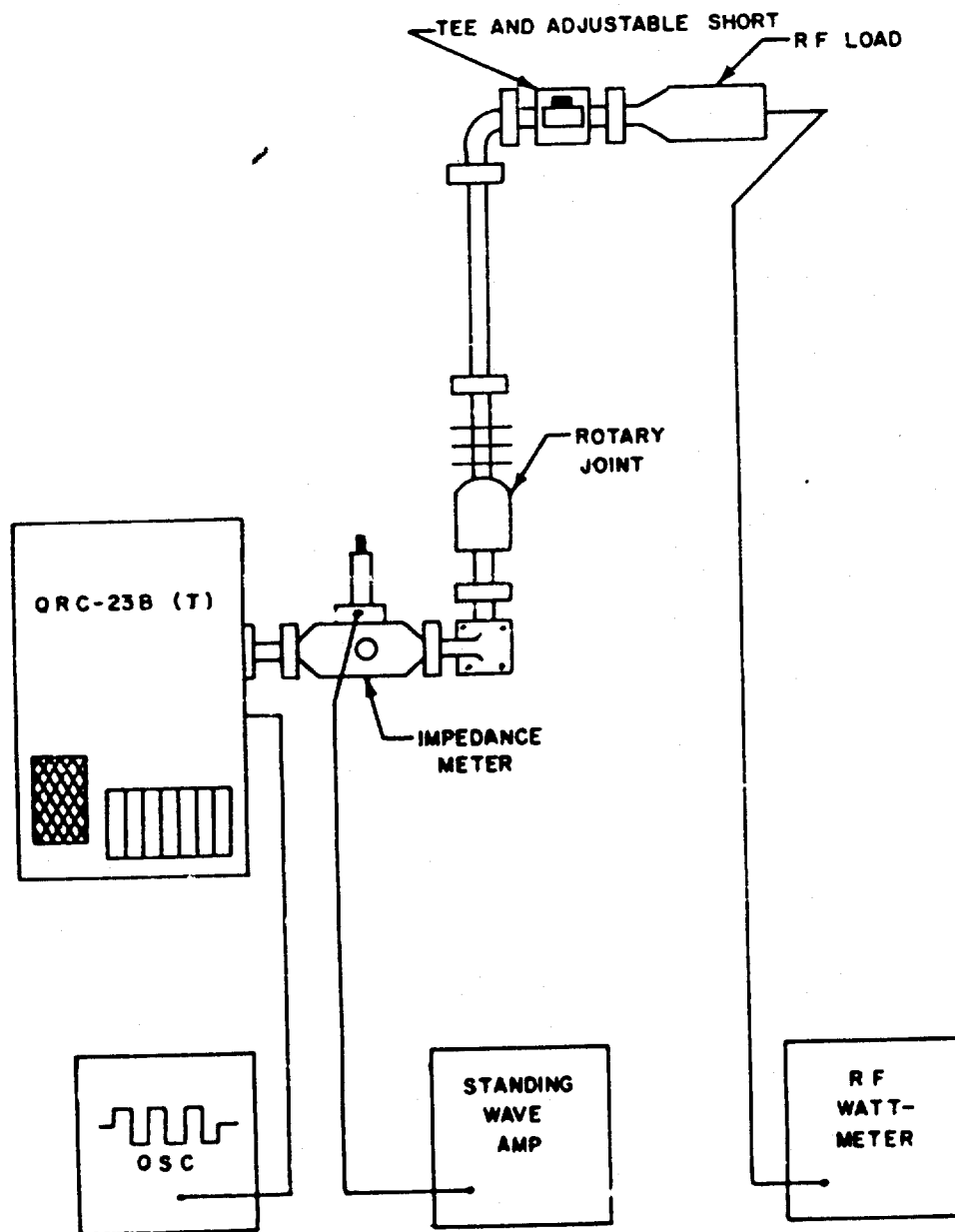


Fig. 1. (U) Equipment setup for test 2

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(4) The VSWR will be increased in increments of 0.2 by tuning the adjustable short. The rf power will be measured at each VSWR up to and including a VSWR of 2.0.

(5) Subparagraphs 3 and 4 will be repeated at rf carrier frequencies of 9.5 kmcs and 10.5 kmcs.

d. (U) Data Required

The data required will be entered on the sample data sheet for test 2.

9. (U) TEST 3. AUXILIARY EQUIPMENT TEST

a. (U) Purpose

The purpose of test 3 is to perform an operational checkout of the AN/APR-9 receiver and AN/ALA-6 direction finder which will be used for instrumentation purposes.

b. (U) Time Required

The time required for this test will be one day.

c. (U) Procedure

The installed receiver and direction finder will be checked out as per the appropriate Handbook of Operating Instructions prior to initiation of the field tests.

d. (U) Data Required

Any comments on performance by the project officer will be recorded.

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Sample Data Sheet for Test 2\*

Calorimeter		Transmitter serial nr _____		
Make _____				
Model _____				
Serial nr _____				
Step nr	VSWR	Power		
		Freq - 8.5 kmcs	Freq - 9.5 kmcs	Freq - 10.5 kmcs
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

\*This data sheet classified SECRET without entries.

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## IV. GROUND-BASED FIELD TESTS

### 10. (U) JAMMING EFFECTIVENESS GUIDE

To evaluate the effectiveness of the jamming, the following legend will be used for A-, B-, and J-scope presentations:

Light jamming: perceptible jamming on scope, but targets clearly visible.

Medium jamming: jamming very noticeable on scope but targets visible to trained operator.

Intense jamming: scope saturated, no targets visible.

For PPI presentations, the jamming conditions are shown in fig. 2.

### 11. (C) INSTRUMENTATION EQUIPMENT

The AN/APR-9 receiver and the AN/ALA-6 direction finding equipment, which are used to complete the system of the QRC-23B(T), will be used for instrumentation.

The AN/APR-9 will be used to ascertain the frequency of the target radar and to bring the jammer up on the same frequency. The AN/ALA-6 will be used to orient the jamming antennas on the bearing of the target radar.

### 12. (S) TEST 4. EFFECT OF VARIOUS JAMMING MODULATIONS ON THE AN/MPQ-10A

#### a. (S) Purpose

The purpose of test 4 is to determine the most effective jamming mode to be used by the QRC-23B(T) against the Radar Set AN/MPQ-10A.

#### b. (U) Time Required

The time required for this test will be three days.

#### c. (U) Procedure

(1) The AN/MPQ-10A will be sited so that it has an unobstructed view of an isolated fixed target approximately 5,000 yards away as shown in fig. 3. The radar will acquire the target and then be placed in automatic tracking mode during the remainder of the test.

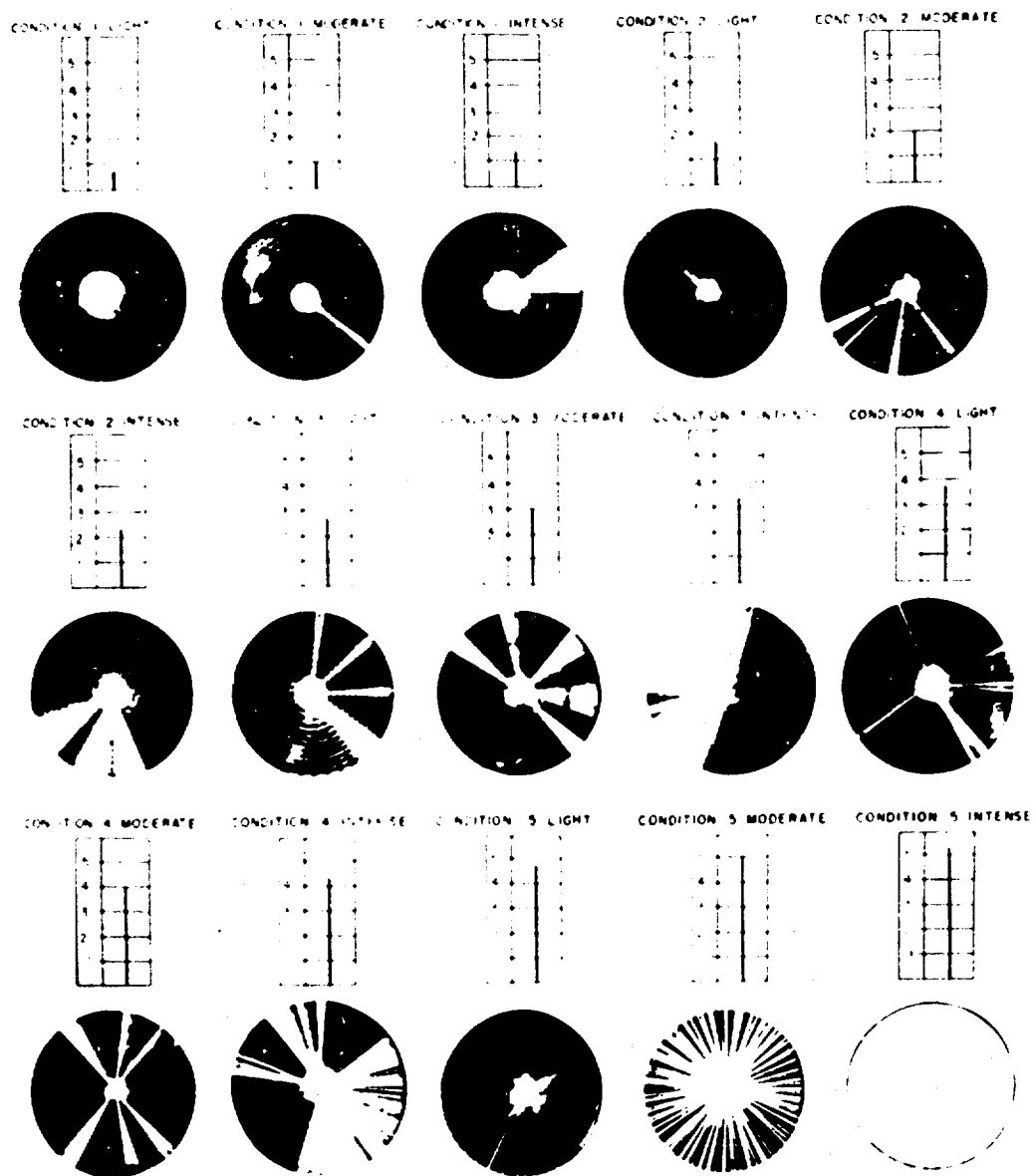


Fig. 2. (U) Legend for jamming results

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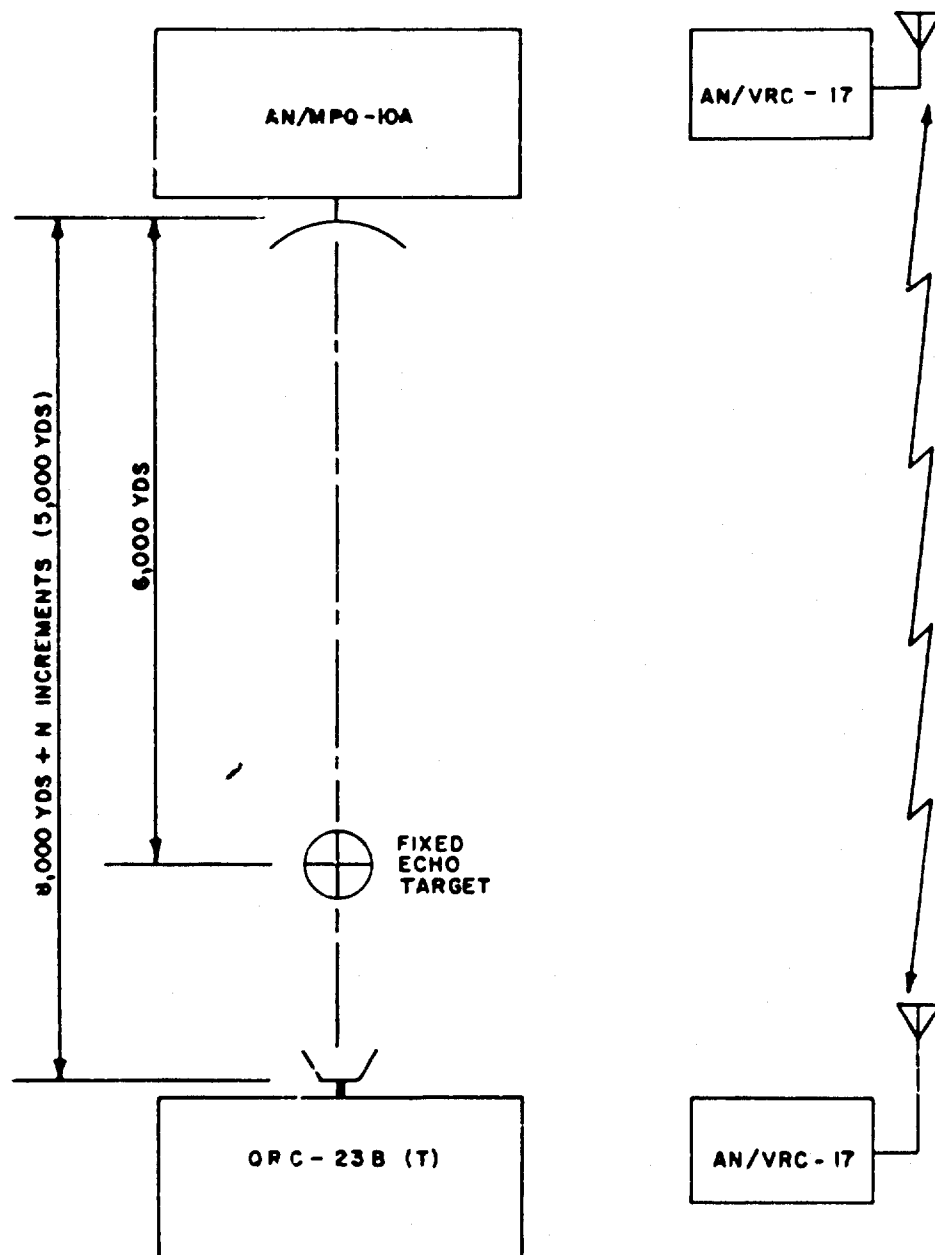


Fig. 3. (CMHA) Siting plan for test 4

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(2) The QRC-23B(T) will be sited approximately 8,000 yards from the radar site in as close to a straight line with the target as possible. All jamming modulations will be tested while the jammer is transmitting on the radar frequency. Since the most effective jamming modulation is desired, the various types of modulations will be tuned through their respective frequency ranges and the results recorded. Photos will be taken of the radar scopes as each type of jamming is presented.

(3) The procedure of subparagraphs 1 and 2 above will be repeated with the jammer-radar distance increased in increments of 5,000 yards until the jamming ceases to be effective.

(4) The antijam switch on the AN/MPC-1CA will be operated in the ON and OFF position for each type of jamming modulation.

d. (U) Data Required

(1) All data required will be entered on data sheet for test 4.

(2) Scope photos and comments by the project officer will be forwarded with the data sheets.

13. (S) TEST 5. EFFECT OF VARIOUS JAMMING MODULATIONS ON THE AN/TPS-21

a. (S) Purpose

The purpose of test 5 is to determine the effect of the various jamming modulations of the QRC-23B(T) on the combat surveillance Radar Set AN/TPS-21; the most effective mode of jamming will be determined.

b. (U) Time Required

The time required for this test will be two days.

c. (S) Procedure

(1) The equipment will be sited as shown in fig. 4. The related corner reflector target will be sited so as to present a good target indication both aurally and visually on the AN/TPS-21. A Tektronix scope model 535 or equivalent will be used to display the video output of the AN/TPS-21.

(2) The AN/TPS-21 will be set in the scanning mode of operation with the target in the center of the scan.

(3) The jammer will be directed along the axis of the target and the radar, and will be switched through its various jamming modes in the following order:



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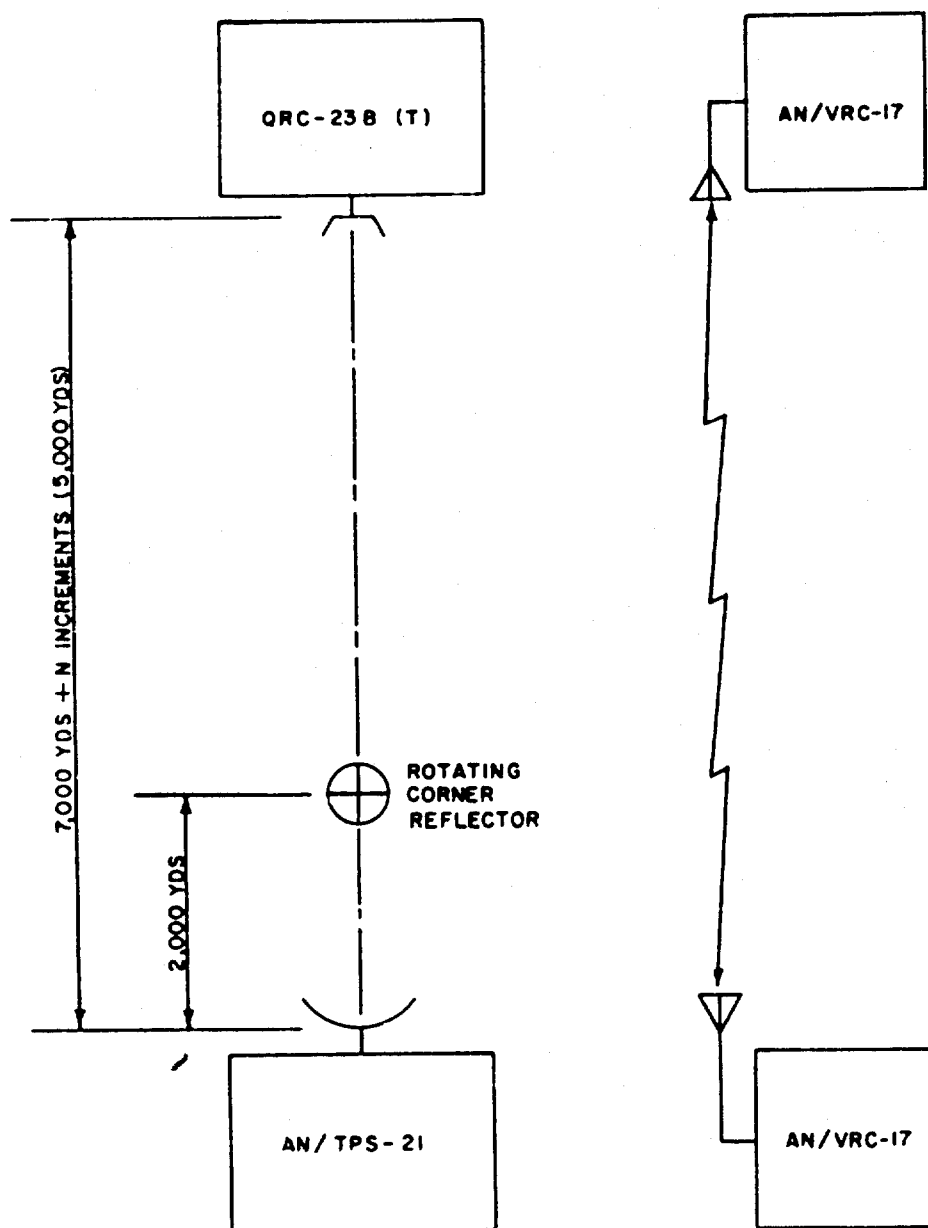


Fig. 4. (CMHA) Siting plan for test 5

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- (a) Continuous wave
- (b) Internal am noise in three steps (30 percent to maximum)
- (c) Internal fm noise in three steps ( $\pm 10$ ,  $\pm 25$ , and  $\pm 50$  mcs) about center frequency
- (d) Frequency sweep in three steps (100 cps, 1,000 cps, and maximum) without overloading
- (e) Combination am maximum modulation and fm maximum deviation
- (f) Combination of frequency sweep and internal fm noise

The effects of each mode of jamming will be recorded on the data sheet and photos taken of each type of jamming displayed on the auxiliary scope.

(4) The AN/TPS-21 will be turned to the track mode and a continuous track of the target will be made while the procedure outlined in subparagraph 3 is again followed.

(5) Procedures outlined in subparagraphs 2 through 4 will be repeated as the jammer is moved farther away from the radar in steps of 5,000 yards until jamming is no longer effective in both of the AN/TPS-21 operating modes.

(6) During the procedure outlined in subparagraph 3, a spectrum analyzer will be set up at the jammer site and photographs (Polaroid) will be taken of each type of jamming modulation.

## d. (U) Data Required

(1) All data required will be entered on the data sheet for test 5.

(2) Comments by the project officer covering operation of equipment, training of the operators, effects of the various modulations, and any difficulties encountered will be recorded.

## 14. (S) TEST 6. LIMITS OF EFFECTIVE JAMMING AREA, S-BAND SYSTEM

### a. (S) Purpose

The purpose of test 6 is to determine the limits of azimuth deviation within which a jamming signal sufficient to interfere with the normal operation of the AN/MPQ-10A can be maintained. The maximum line-of-sight jamming distance will also be determined.

### b. (U) Time Required

The time required for this test will be three days.

# Sample Data Sheet for Test 5\*

Local weather	Date		
Radar coordinates	Radar serial nr		
Target coordinates	Jammer power output		
Jammer coordinates	Jammer serial nr		
Range (radar-target)	Radar frequency		
Range (radar-jammer)	Jammer frequency		

Step nr	Modulation type	Degree of jamming			Time to break track	Remarks**
		Light	Medium	Intense		

\*This data sheet is UNCLASSIFIED until filled in.  
 \*\*Describe modulation; record all dial settings.



c. (U) Procedure

(1) The equipment will be sited as shown in fig. 5. The QRC-23B(T) will be sited at point A, on road nr 1 where it will attempt to jam with the most effective modulation as determined by test 4. The mortar locator will be placed in sector scan with the balloon-borne target at the center of the scan. The condition of jamming will be recorded.

(2) The radar will then attempt to track and lock-on the balloon-borne target. If this is unsuccessful, the jammer will be turned off until the radar can acquire and lock-on the target. The condition of jamming and the ability of the jammer to break the track of the radar will be noted.

(3) The jammer and radio truck will move to point B (these points will have been previously staked out along the road) where procedures described in subparagraphs 1 and 2 will be repeated. Line of sight should be maintained at each point. Deviations from the road or increased distance along the road may be necessary, but it is desirable that these deviations be kept to a minimum.

(4) The jammer will continue along the road to the designated points (C, D, E, and F) repeating procedures described in subparagraphs 1 and 2, until a point is reached at which the jammer is no longer effective in causing the radar to break track.

(5) The distance between the radar and jammer will be increased to 12,000 yards (road nr 2) and the jammer will be positioned at points A', B', etc. Procedures outlined in subparagraphs 1 through 4 will be repeated. If the stated distances from the radar to the road are not available for use, the distance from radar to target must still be at least 5,000 yards.

(6) If the jamming from the points on road nr 2 is still effective, another increment of 5,000 yards between radar and jammer should be used. In this event, the increment between jamming points will be 2,000 yards and the procedures described in subparagraphs 1 through 4 will be repeated.

(7) When the above portion of the test is completed, the jammer will be moved along the line formed by points A, A', the target, and the radar to a distance from which effective jamming can be obtained. This will give the line-of-sight, maximum effective jamming distance.

d. (U) Data Required

(1) Data required will be entered on the data sheet for test 6.

(2) Notes and comments will be turned in by the project officer.

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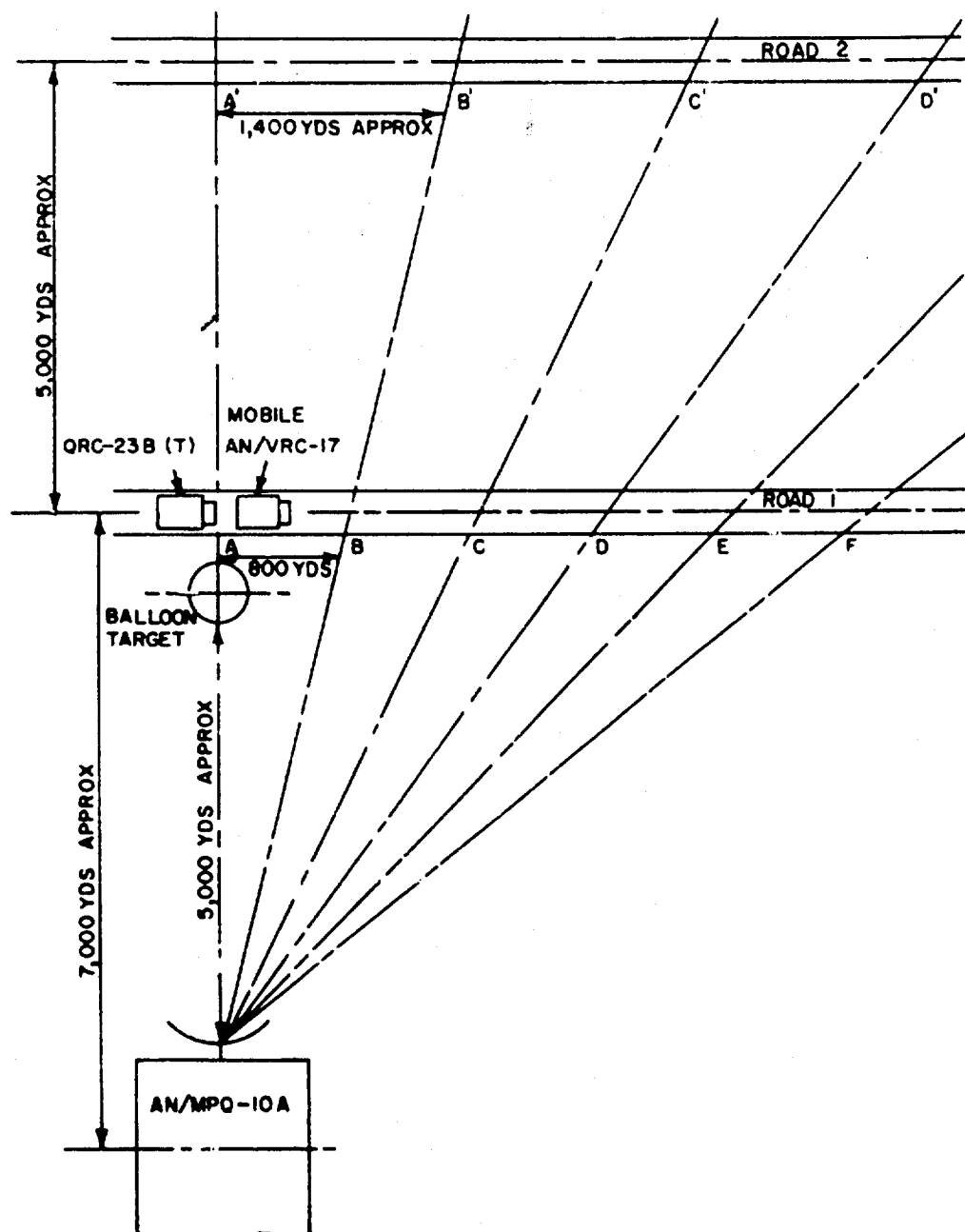


Fig. 5. (CMHA) Siting plan for test 6

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Sample Data Sheet for Test 6\*

Local weather _____		Date _____				
Radar coordinates _____		Target serial nr _____				
Radar serial nr _____		Jammer power output _____				
		Type modulation _____				
Step nr	Jammer coordinates	Jammer antenna azimuth	Degree of jamming			Remarks
			Light	Medium	Intense	

\*This data sheet is UNCLASSIFIED until filled in.

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## 15. (S) TEST 7. LIMITS OF EFFECTIVE JAMMING AREA, X-BAND SYSTEM

### a. (S) Purpose

The purpose of test 7 is to determine the limit of deviation and maximum distance between the QRC-23B(T) and AN/TPS-21 antennas within which a jammer signal sufficient to interfere with the normal operation of the radar set can be maintained.

### b. (U) Time Required

The time required for this test will be three days.

### c. (C) Procedure

(1) The equipment will be sited as shown in fig. 6. The road will be staked out in 800-yard sections. The target vehicle will be a 3/4-ton truck with an AN/VRC-17 mounted.

(2) The QRC-23B(T) antenna will be oriented so that it is pointed directly at the AN/TPS-21. The QRC-23B(T) operator will jam only on order.

(3) The 3/4-ton truck will travel from points A to G during which time the radar will search for and track the vehicle. When the radar is on track, the jammer will be turned on in the most effective modulation as found in test 5, and attempt to break the track of the radar.

(4) The truck will return from point G to point A and the preceding operation will be repeated. At this time, the radar operator will notify the truck when track is broken, and the crew of the truck will note the position of the truck by the stakes.

(5) The jammer will be moved 5,000 yards farther from the radar and the procedures outlined in subparagraphs 3 and 4 will be repeated. If the jamming is still effective in breaking the track of the radar, the jammer will be moved another 5,000 yards away from the radar and the procedures repeated.

(6) When the preceding steps have been completed, the maximum line-of-sight jamming distance will be ascertained. At this distance, the jamming must be able to break the track of the radar. The radar will be trained on a moving target as directly in line with the jammer as possible.

(7) A minimum of three runs will be made for each jammer range.

### d. (U) Data Required

(1) Data as required will be entered on the data sheet for test 7.

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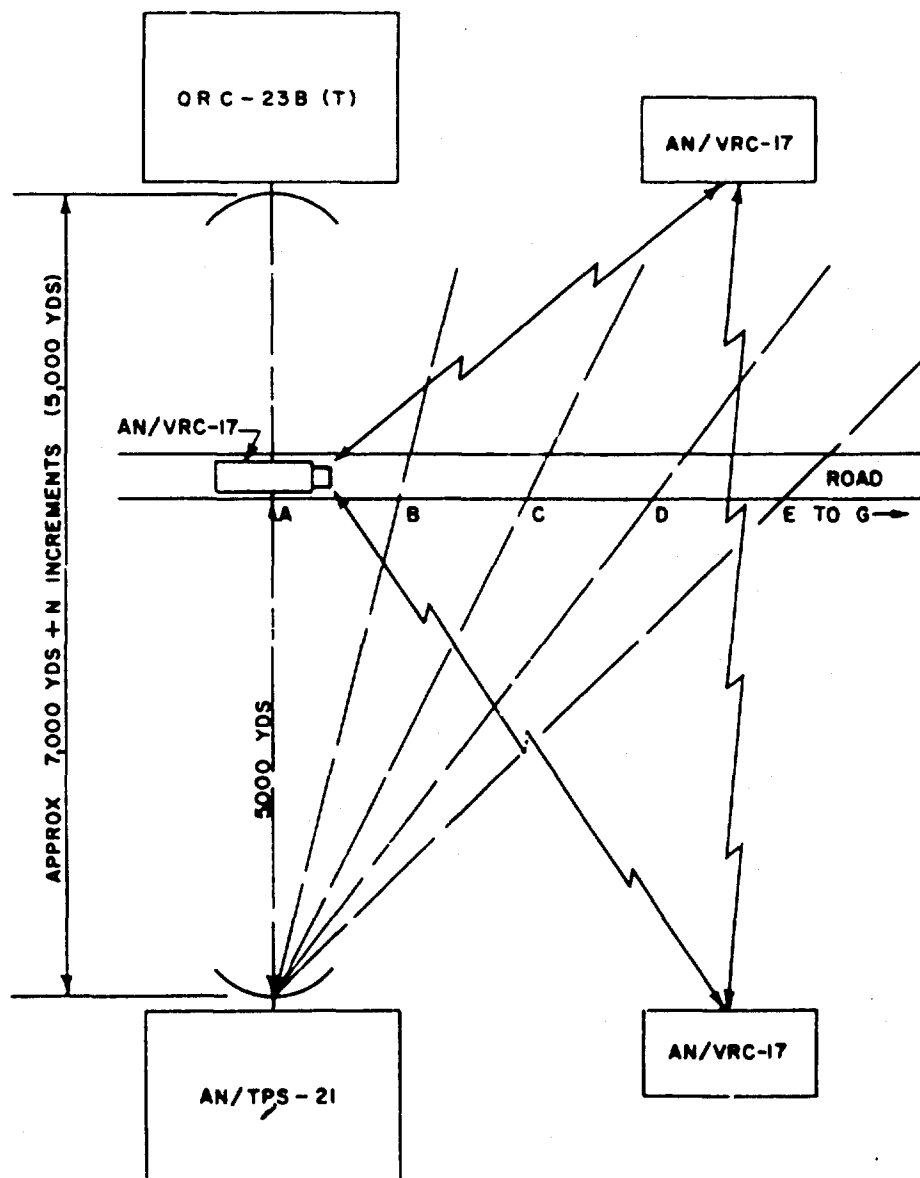


Fig. 6. (CMHA) Siting plan for test 7

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Sample Data Sheet for Test 7\*

Local weather _____				Date _____	
Radar coordinates _____				Target truck nr _____	
Jammer coordinates _____				Jammer serial nr _____	
				Jammer power output _____	
				Type modulation _____	
Step nr	Radar antenna azimuth with respect to jammer	Degree of jamming			Remarks
		Light	Medium	Intense	

\*This data sheet is UNCLASSIFIED until filled in.

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(2) Notes and comments by the project officer will be recorded.

16. (S) TEST 8. EFFECTIVENESS AGAINST MORTAR-LOCATING RADAR AN/MPQ-10A

a. (S) Purpose

The purpose of this test is to determine the effectiveness of the QRC-23B(T) against the mortar-locating Radar Set AN/MPQ-10A in the track mode of operation.

b. (U) Time Required

The time required for this test will be two days.

c. (C) Procedure

(1) The equipment will be sited as shown in fig. 7.

(2) The AN/MPQ-10A will be put in normal operation, scanning the sector near the mortar. The radar signal will be intercepted by the AN/APR-9 and the jammer tuned to this frequency. The jamming antenna will be oriented in azimuth for maximum jamming of the radar. The most effective jamming mode, as determined in test 4, will be used.

(3) On signal, the mortar will fire sufficient rounds to allow the AN/MPQ-10A to obtain track.

(4) The mortar will fire five single rounds on command. As soon as the radar operator is "on target," a signal will be given to the jammer crew to jam. The effect produced upon the radar, including the time required by the jammer to make the radar break track, will be recorded for each round fired.

(5) Four rounds will be fired from the mortar with the jammer radiating continuously. The radar will attempt to obtain track on the round through the jamming.

(6) The mortar will be swung 200 mils to the right; two rounds will be fired for adjustment of the radar.

(7) The procedures described in subparagraphs 4 and 5 will be repeated. The turning of the mortar in 200-mil increments will be accomplished after each procedure series until the jamming is less than 30-percent effective. If the decrease in effectiveness occurs in one 5,000-yard step, increments will be run in the reverse direction to obtain the cutoff point of the jamming.

(8) The jammer will be moved away from the mortar in increments of 5,000 yards until the jamming is no longer effective. Procedures described in subparagraphs 3, 4, 5, and 6 will be repeated at each site.

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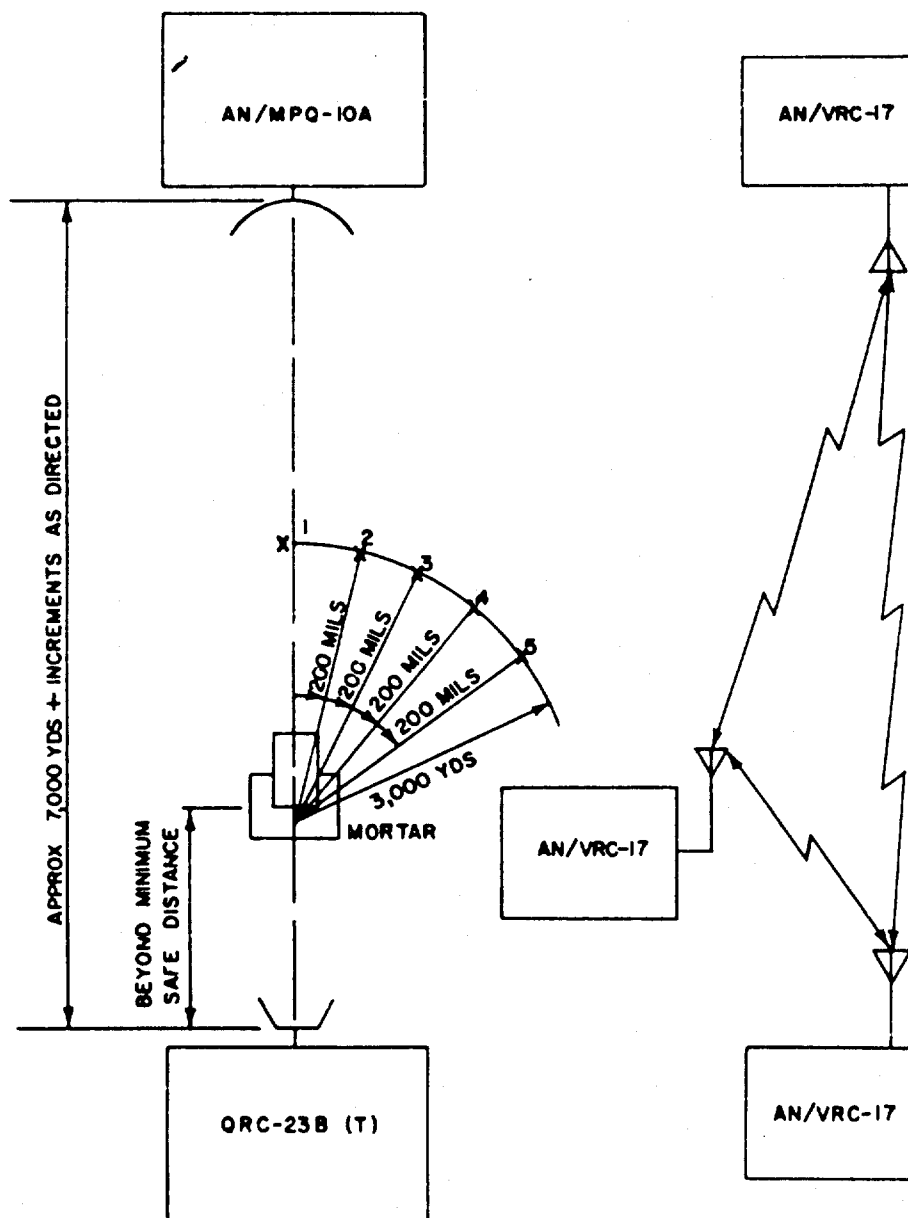


Fig. 7. (CMA) Siting plan for test 8

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(9) Antijam techniques will be used.

d. (U) Data Required

(1) The data required will be entered on the data sheet for test 8.

(2) Photographs of the AN/APQ-10A scope during track, and showing clear scope and jammed scope, will be taken.

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Sample Data Sheet for Test 8\*

Local weather _____		Range _____		Date _____	
Radar coordinates _____		Target coordinates _____		Jammer power output _____	
Jammer coordinates _____		1. _____		Jamming mode _____	
		2. _____			
		3. _____			
		4. _____			
		5. _____			

Round nr	Target nr	Purpose of round	Radar target spotted	Time for radar to break track	Remarks

\*This data sheet is UNCLASSIFIED until filled in.

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## V. AIRBORNE FIELD TESTS

### 17. (S) TEST 9. EFFECTIVENESS AGAINST M-33 RADAR

#### a. (S) Purpose

The purpose of test 9 is to determine the effectiveness of the airborne QRC-23B(T) at various ranges and heights against the tracking and surveillance radars of the M-33 AA Fire Control System.

#### b. (U) Time Required

The time required for this test will be two days.

#### c. (S) Procedure

(1) The M-33 surveillance radar will be sited so that it has a broad unobstructed view directly to the front. The surveillance radar will be placed in normal search operation. The flight paths as shown in fig. 8 will be directed by an auxiliary M-33. The most effective jamming mode as determined in the ground test will be used.

(2) Flight 1 will be flown at a constant distance of 6 miles from the target radar, and at an altitude 3,000 feet above it. The auxiliary M-33 will notify the pilot and the target radar when the airborne QRC-23B(T) is at point A. The plane will fly at 90 knots from points A to B with the jamming equipment turned on. Jamming condition notes will be taken at points A, B, and C.

(3) Flight 2 will repeat the procedure described in subparagraph 2 at a constant distance of 15 miles from the target radar.

(4) Flight 3 will be flown radially away from the radar until jamming is no longer effective. This distance will be plotted by the auxiliary M-33.

(5) Procedures described in subparagraphs 2, 3, and 4 will be repeated with the QRC-23B(T) at 1,500 feet altitude above the target radar.

(6) The above procedures will be repeated against the tracking radar of the target M-33. The plane will be tracked by the radar and when "on track" is announced, the jammer will attempt to disrupt the track. If this is accomplished, the target radar will notify "off

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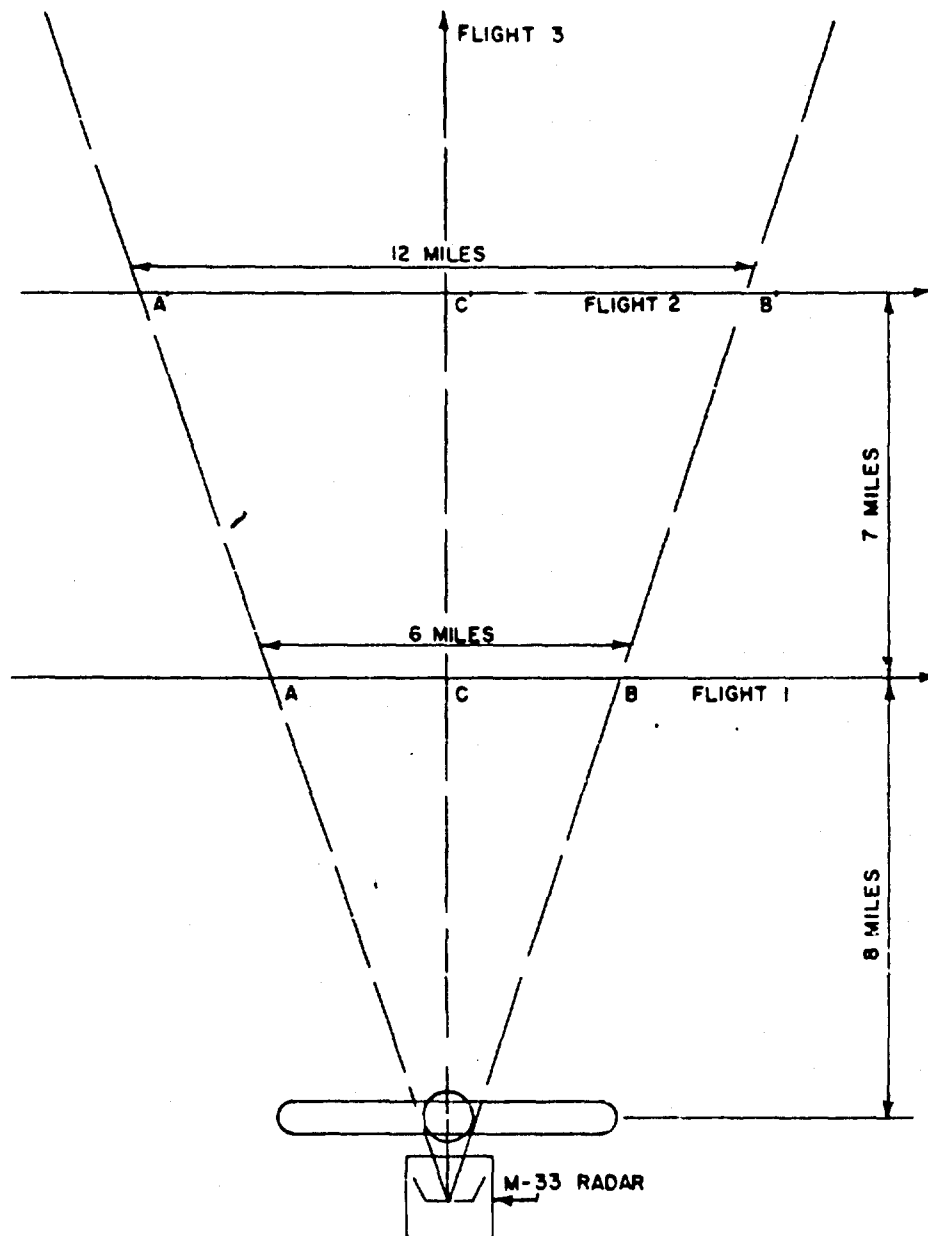


Fig. 8. (CMHA) Flight and location plan for test 9

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track" and the jamming will be halted. This procedure will be continued along each of the flight paths until the track can no longer be broken.

### d. (U) Data Required

(1) Data required will be entered on the data sheet for test 9.

(2) Photographs taken of jammed scopes of the M-33 radar will be correlated with the data sheet.

(3) Notes and comments by project officer will be recorded.

### 18. (S) TEST 10. EFFECTIVENESS OF SIDE AND BACK LOBE JAMMING AGAINST THE AN/TPQ-10A

#### a. (S) Purpose

The purpose of test 10 is to determine the effectiveness of the airborne CRC-23B(7) at various bearings and heights against the ground-based Radar Set AN/TPQ-10A.

#### b. (U) Time Required

The time required for this test will be two days.

#### c. (U) Procedure

(1) The equipment will be sited and the flights performed as shown in fig. 9.

(2) For flight 1, the aircraft will fly the path indicated in fig. 9, at a height of 3,000 feet, above the target radar and at a speed of 90 knots. The radar will be sector scanning an area of 800 mils, the elevation angle to be such that most ground clutter is omitted.

(3) An M-33 radar will be used to keep the plane on the flight path, and notify the plane and target radar when the plane is at points A, B, C, etc. Photographs will be taken of the AN/TPQ-10A scope to show the degree of jamming at these points.

(4) Flight 2 will repeat flight 1, except the horizontal range from aircraft to target radar will be 5,000 yards.

(5) Flights 1 and 2 will be repeated at an aircraft altitude above terrain of 1,500 feet.

#### d. (U) Data Required

(1) M-33 plots and photographs of jamming at specified points will be correlated with the data sheet.

Sample Data Sheet for Test 9\*

Local weather _____		Date _____	
Radar coordinates _____		Jammer serial nr _____	
Radar serial nr _____		Jammer power output _____	
		Type modulation _____	

Flight nr	Letter designation	Altitude (ft)	Condition of jamming	Time on target radar	Time to break track	Remarks

\*This data sheet is UNCLASSIFIED until filled in.

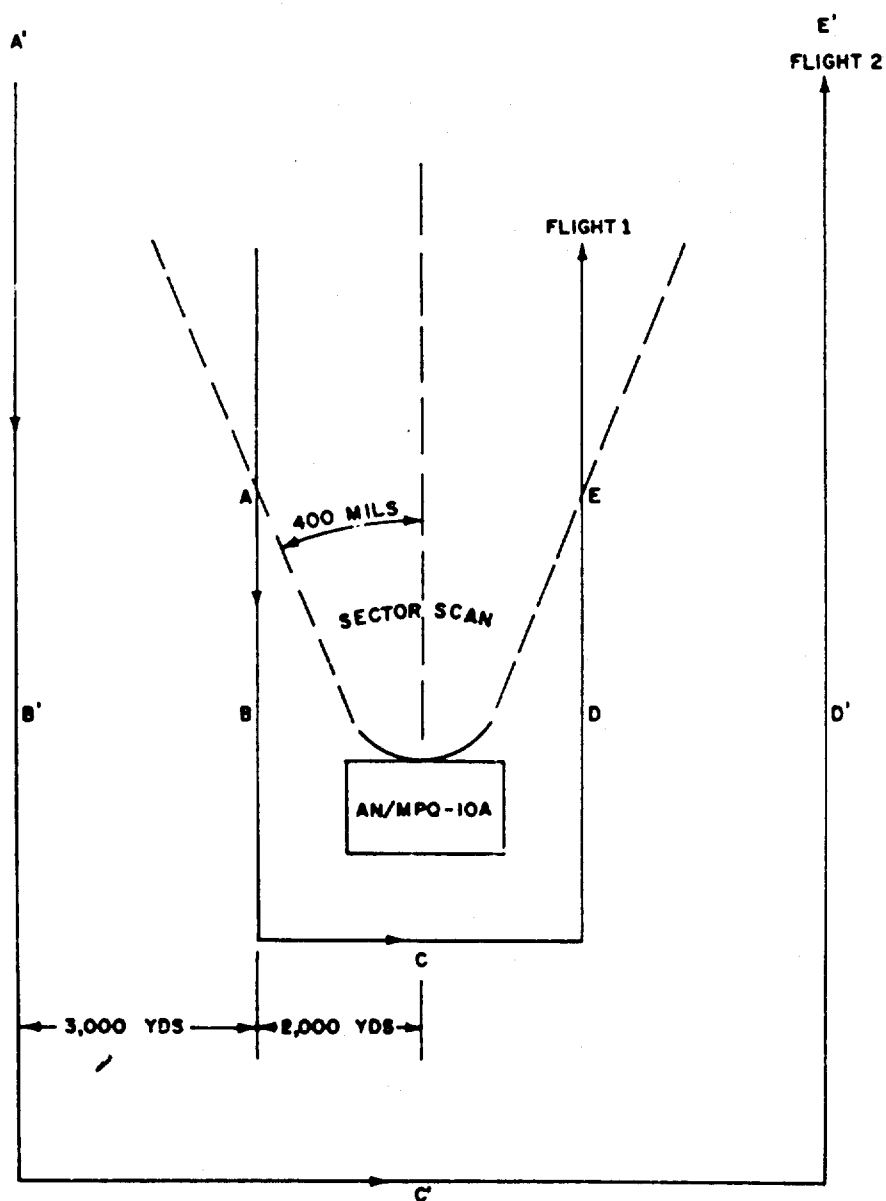


Fig. 9. (U) Flight and location plan for test 10

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(2) Notes and comments by the project officer and operators will be recorded.

(3) Data required will be entered on the data sheet for test 10.

19. (S) TEST 11. EFFECTIVENESS AGAINST MORTAR-LOCATOR RADAR AN/MPQ-10A

a. (S) Purpose

The purpose of test 11 is to determine the effectiveness of the airborne QRC-23B(T) in breaking the track of the mortar-locator Radar Set AN/MPQ-10A.

b. (U) Time Required

The time required for this test will be two days.

c. (S) Procedure

(1) The mortar-locating radar AN/MPQ-10A will be sited with a broad field of view, and placed in normal sector-scan operation. A mortar will be located approximately 6,000 yards from the radar. Upon notification from the aircraft carrying the QRC-23B(T) that it is beginning a run, the mortar crew will begin firing one round per minute, using a range of 3,000 yards.

(2) The flight and location plan for this test is shown in fig. 10.

(3) For flight 1, the AN/APR-9 will intercept the radar signal as it is tracking projectiles fired by the mortar. For flight 2, the aircraft will notify the mortar crew and radar crew when it is at point A and attempt to jam the radar when it is on track.

(4) The plane will be directed on its flight path by M-33 radar.

(5) Flights 3 and 4 will repeat the procedure described in subparagraph 3 at a range of 8 miles.

(6) Flights 5 and 6 will repeat this procedure at a range of 15 miles.

d. (U) Data Required

(1) The plot of the M-33 and defined photographs from points A, B, C, etc., on fig. 10 will be required.

(2) Notes and comments by project officer and operators will be recorded.



Sample Data Sheet for Test 10\*

Local weather _____		Date _____
Radar coordinates _____		Jammer serial nr _____
Radar serial nr _____		Jammer output _____
		Type modulation _____
Flight nr	Letter designated point	Jamming condition
		Remarks

\*This data sheet is UNCLASSIFIED until filled in.

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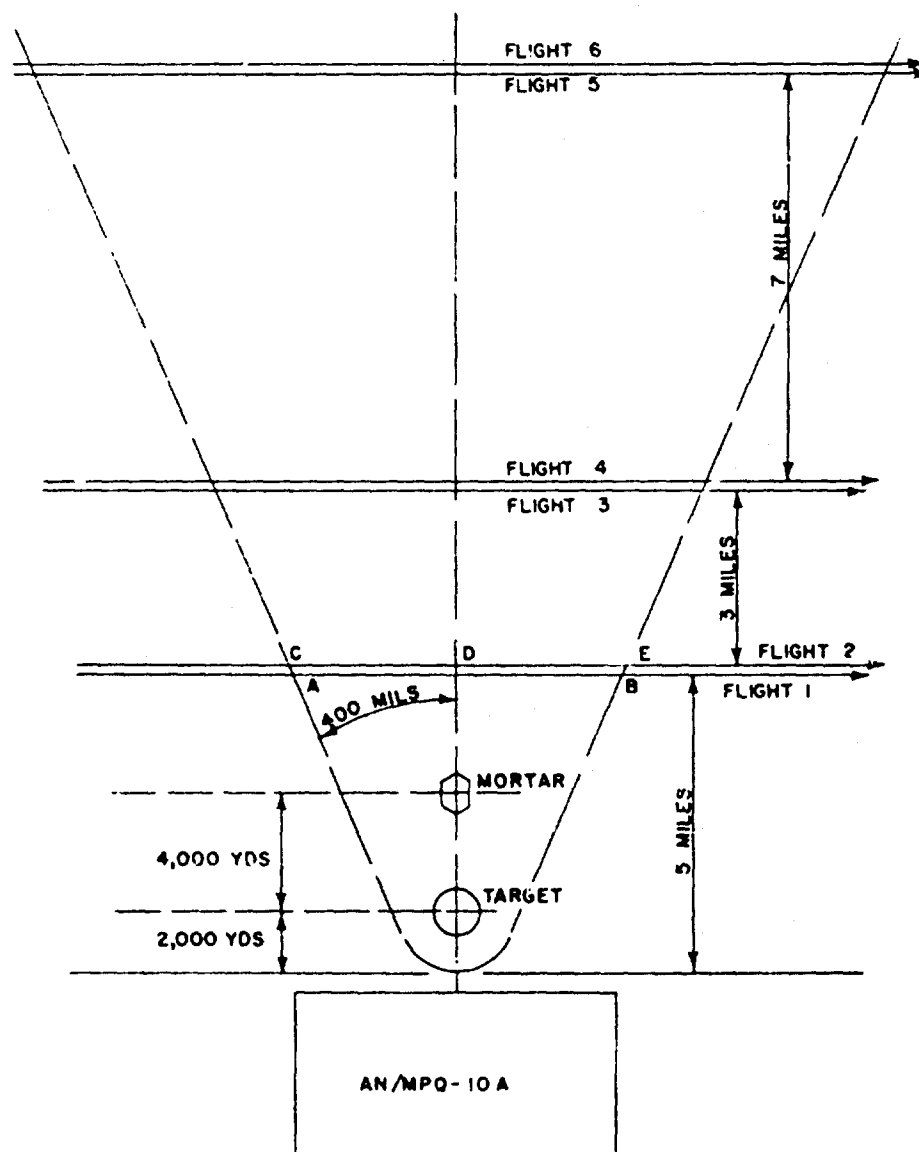


Fig. 10. (CME-1A) Flight and location plan for test 11

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(3) Data required will be entered on the data sheet for test 11.

### 20. (S) TEST 12. EFFECTIVENESS AGAINST THE RADAR TRACKER T-9

#### a. (S) Purpose

The purpose of test 12 is to determine the effectiveness of the airborne QRC-23B(T) in breaking the track of the Radar Tracker T-9, a component of the AA Fire Control System T-33.

#### b. (U) Time Required

The time required for this test will be two days.

#### c. (S) Procedure

(1) The T-9 will be sited with a broad field of view. The aircraft with the QRC-23B(T) will fly a course as indicated in fig. 11, at 3,000 feet.

(2) The T-9 will acquire and track the aircraft. The AN/APR-9 will intercept the radar signal, and on command the QRC-23B(T) transmitter will jam.

(3) The aircraft will make four flights. Flight 1 will be at a ground distance of 8 miles, and flight 2 at 15 miles from the T-9. For flight 3, the aircraft will start at a ground range of 3 miles, and fly directly away from the radar until jamming effectiveness is lost. Flight 4 will begin at point A and fly the back and side lobes of the radar while jamming continuously. Photographs will be taken at points D, E, and F.

(4) Flight 1 will be run again with the radar oriented 180 degrees away from the aircraft and then again at 90 degrees from the aircraft.

(5) A tracking or surveillance radar and recorder will be used to obtain a record of the flight path of the aircraft.

#### d. (U) Data Required

(1) Plots by the M-33 radar will be required.

(2) Photographs of the radar scopes at points A, B, C, etc., will be taken and observers' comments recorded before and during jamming.

(3) Time required for radar to lose track from the start of jamming will be noted. Data required will be entered on data sheet for test 12.

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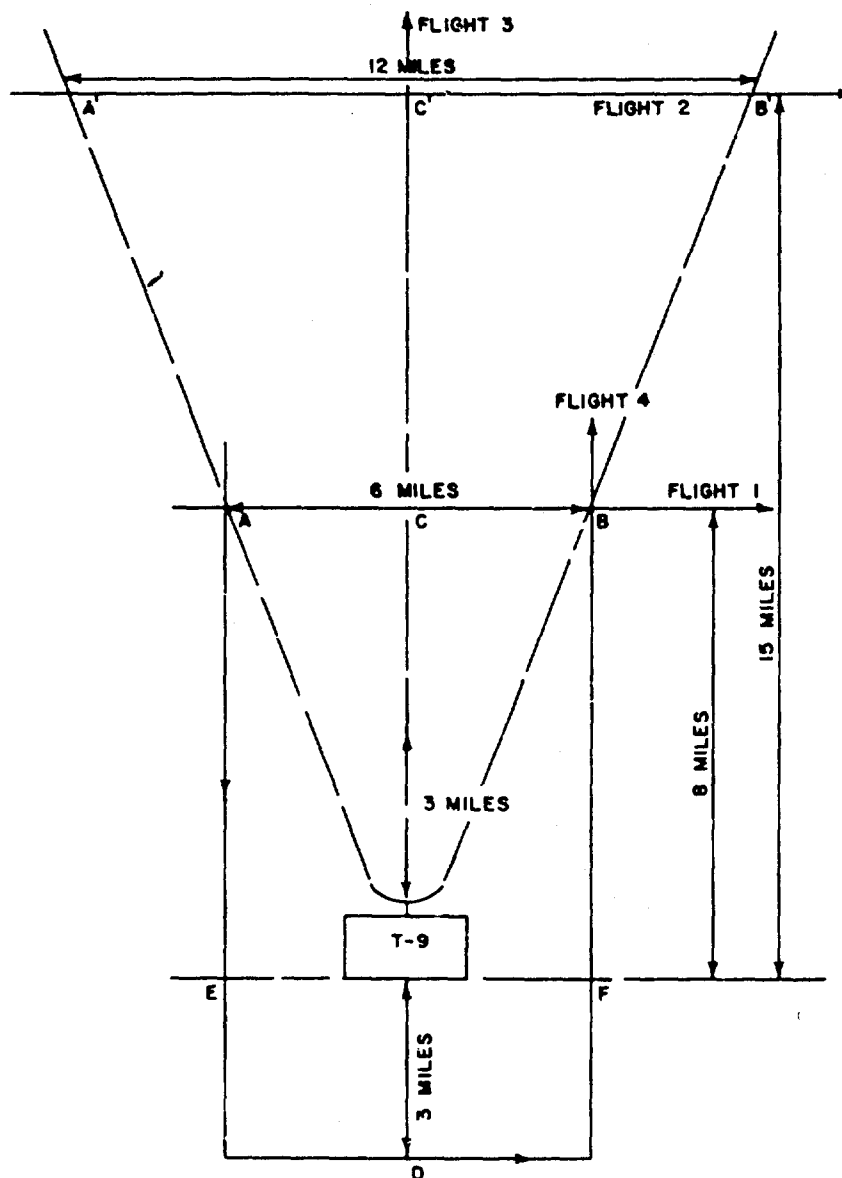


Fig. 11. (CMHA) Flight and location plan for test 12

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Local weather _____ Date _____					
Radar coordinates _____ Jammer serial nr _____					
Radar serial nr _____ Type modulation _____					
Flight nr	Letter designated point	Condition of jamming	Time on track	Time to break track	Remarks

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(4) Results will be noted using antijam techniques.

(5) Comments by project officer and operators will be recorded.

### 21. (S) TEST 13. EFFECTIVENESS AGAINST AN AIR-TRACKING RADAR

#### a. (S) Purpose

The purpose of test 13 is to determine the amount of protection afforded another plane by the airborne QRC-23B(T) against the air tracking radar AN/CPG-1.

#### b. (U) Time Required

The time required for this test will be one day.

#### c. (S) Procedure

(1) The flight and location plan for this test is shown in fig. 12. An L-19 aircraft will be used as a target for the radar.

(2) An M-33 radar will be used to direct the flights of the target plane and the aircraft carrying the QRC-23B(T). The L-19 will fly at an altitude of 1,000 feet.

(3) Flight 1 of the jammer aircraft will be flown at an altitude of 1,500 feet and at a distance of 8 miles from the target radar. The flights will be synchronized so that the jammer aircraft will reach point A after the target radar has the L-19 on track. The jammer will be turned on at this time and be turned off as soon as the target radar signifies it can no longer track the L-19. This will be continued until jamming conditions can be ascertained when the target plane and the ECM aircraft are at opposite extremes of their respective flight paths. The time for the jammer to break the track of the target radar will be determined.

(4) Flight 2 will repeat the procedures with the U1-A at an altitude of 3,000 feet, and the L-19 remaining at 1,000 feet.

#### d. (U) Data Required

(1) Track of planes by the M-33 and a record of the plot will be required.

(2) Radar scope photograph of jamming conditions will be taken.

(3) Notes and comments by project officer regarding conduct of test will be recorded.

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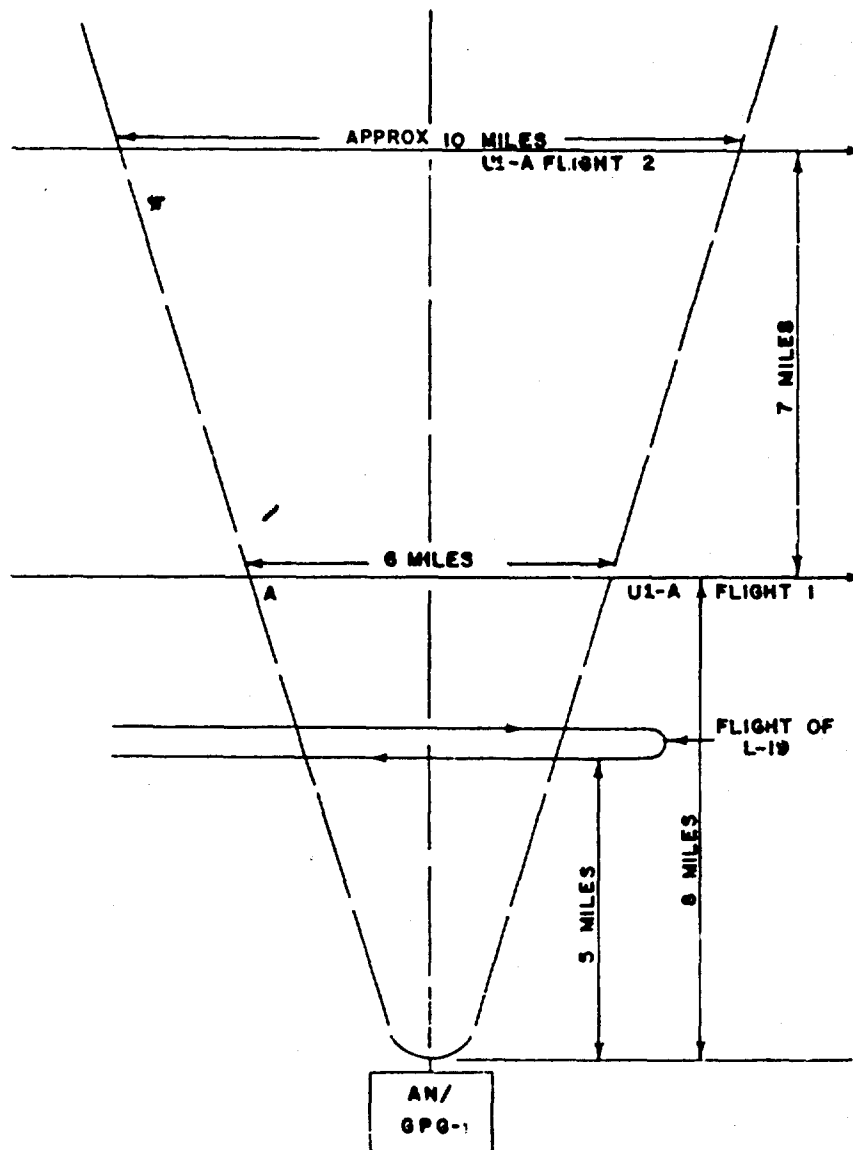


Fig. 12. (CMHA) Flight and location plan for test 13

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### 22. (S) TEST 14. EFFECTIVENESS AGAINST A COMBAT-SURVEILLANCE RADAR

#### a. (S) Purpose

The purpose of test 14 is to determine the effectiveness of the airborne QRC-23B(T) jammer against a ground-based, combat surveillance Radar Set AN/TPS-21.

#### b. (U) Time Required

The time required for this test will be one day.

#### c. (S) Procedure

(1) The flight plan and siting of equipment is as shown in fig. 13. The AN/TPS-21 will track the target truck while it proceeds from point A to B.

(2) After the target radar has the truck "on track," the aircraft carrying the QRC-23B(T) will commence flight 1 at 1,500 feet above the radar. The jammer will be turned on and off only by command. The condition of jamming will be recorded continuously for each flight and correlated with the position of the target truck and the aircraft. As many flights as necessary at each distance will be made as the truck proceeds along its route.

(3) The procedure will be repeated at distances of 10 and 15 miles from the radar for flights 2 and 3.

(4) A plot of the flight plan of the aircraft will be made by an M-33 radar which will direct the jammer aircraft on the various flight paths.

#### d. (U) Data Required

(1) Data as required will be entered on the data sheet for test 14.

(2) Notes and comments by project officer will be recorded.

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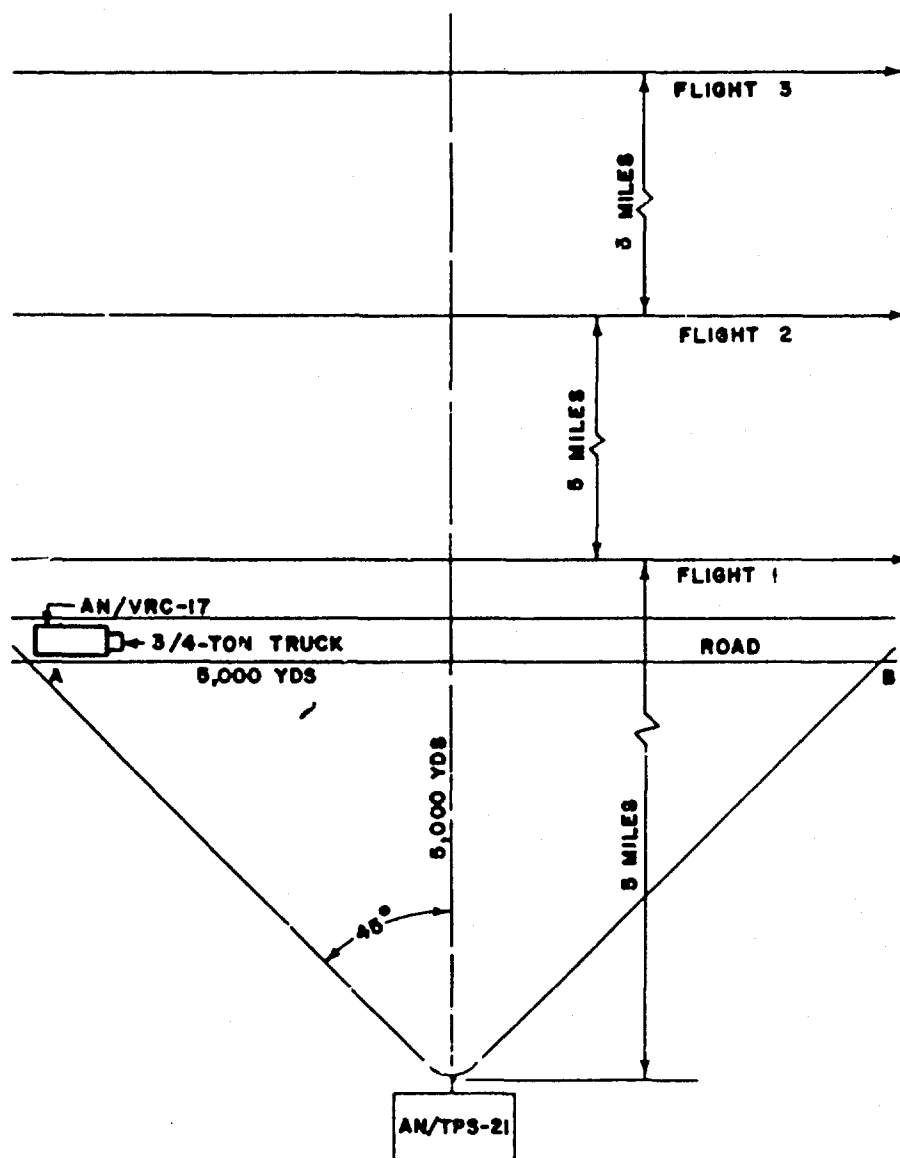


Fig. 13. (CMHA) Flight and location plan for test 14

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Sample Data Sheet for Test 14\*

Local weather _____		Date _____	
Radar coordinates _____		Jammer serial nr _____	
Radar serial nr _____		Type modulation _____	
Flight nr	Asimuth of radar antenna to aircraft	Condition of jamming	Ability to track Remarks

\*This data sheet is UNCLASSIFIED until filled in.

## VI. MAN-MACHINE TEST

### 23. (U) TEST 15. MAN-MACHINE COMPATIBILITY

#### a. (U) Purpose

The purpose of test 15 is to determine the extent of man-machine compatibility in the operation of the QRC-23B(T).

#### b. (U) Time Required

This test will be performed concurrently with other tests.

#### c. (U) Procedure

(1) Human engineering personnel will conduct preliminary observations of equipment setup, operation, and march-ordering of the QRC-23B(T) in order to gain familiarity with the equipment, and will devise an Observer's Record Form and an Interview Record Form on the basis of these observations. Both forms will be semistructured, permitting systematic, preplanned inquiry of man-machine relationships in all aspects of field use of the jammer covered by associated tests.

(2) Human engineering personnel will then observe man-machine relationships with each of several operators and record appropriate observations made of each operator on the Observer's Record Form. At the conclusion of every observation period, each operator will be interviewed independently, and his comments will be recorded on the Interview Record Form. Evaluation of the equipment will be based on data obtained through use of these forms.

(3) It is anticipated that six operators experienced in operating the jammer will be observed and interviewed.

#### d. (U) Data Required

The following data are required:

- (1) Observation information on the performance of each operator
- (2) Interview information from each operator
- (3) Names of operators, observers, and interviewers; dates of observations and interviews; abnormal test conditions which were present

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60. U. S. Army Security Agency Operations Center, Bldg. 1012, Fort Monmouth, N. J.	2